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DRAWINGS AND DESCRIPTIONS
OF
APPARATUS USED IN SALMON AND TROUT CULTURE
AT THE
SANDFORT FISH FARM, OSNABRÜCK, GERMANY,
AND EXHIBITED BY THE DEPARTMENT
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DRAWINGS AND DESCRIPTIONS OF APPARATUS USED IN SALMON AND TROUT CULTURE

AT THE

SANDFORT FISH FARM, OSNABRÜCK, GERMANY,

AND EXHIBITED BY THE DEPARTMENT AT

CORK INTERNATIONAL EXHIBITION, 1902.

GENERAL NOTES.

Among the apparatus for the artificial propagation of salmon and trout exhibited by the Department of Agriculture and Technical Instruction at the Cork Exhibition of 1902 were the appliances used by Herr Siegfried Jaffé, of Sandfort, Osnabrück. As these, from their simplicity of construction and working, seemed likely to be of use to many who are interested in fish culture in this country, the following drawings have been prepared in order to enable those who wish to use the apparatus to construct it for themselves.

It is of the greatest importance that all joints should be made thoroughly tight at the start. Continual drips cause dirt and discomfort in a hatchery, and it is not generally realised through what a small aperture several thousands of fry will escape in the course of a single night.

The perforated zinc of commerce is generally rough on one side; in every case the rough side should be turned away from the eggs or fry.

All the woodwork should be tarred or varnished. If tar is used, it should be laid on hot or thinned with turpentine, in several coats, in order to soak as far as possible into the wood. The proper varnish is "Asphaltum Varnish for hatchery purposes," which is manufactured by Sissons Bros., Ltd., of Hull.

All the wire netting and perforated zinc must be given three coats of this varnish. As the surface of the zinc will generally be greasy, it must be very thoroughly cleansed with soap and water before applying the varnish. Eggs must in no case be allowed to lie in contact with the bare metal.

It is advisable to give the apparatus a complete coat of tar or varnish annually, for the sake of disinfecting it as well as of preserving it. It should be allowed to soak for several days afterwards before putting in eggs or fry.

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APPARATUS FOR USE IN THE HATCHERY.

Herr Jaffé recommends the use of two different patterns of trough for the earlier and later stages of hatching.

The first of these, termed the "Incubating Trough," is intended to accommodate the eggs from fertilization until the eyed stage is reached.

The second, or "Hatching Trough," takes the eggs from the eyed stage until they hatch, and may be used to retain the fry until the yolk is absorbed, if they are not transferred to "Floating Fry Nurseries."

In the case of a hatchery system under which the eggs would be hatched in "Floating Redds" in the streams where it is intended to enlarge them, the "Incubating Trough" would naturally be selected for use at the central or incubating station; but if it be intended to retain the eggs in the hatchery until hatched, the use of both "incubating" and "hatching" troughs, though desirable, is not essential, since the eggs can be dealt with from the earliest stages in the "hatching" trough, especially if a second set of coarse zinc trays be provided.

For the number of eggs accommodated, the "Incubating Trough" is considerably the cheaper, but is not considered to be entirely suitable for actual hatching. Where, however, the supply of water is ample, this pattern of trough, with the necessary alterations in structure (and cost) appears likely to give good results.

SANDFORT INCUBATING TROUGH.

The objects for which this trough has been designed are described above. It is made in the form of a box 6¼ inches deep inside, with the lower end cut away to 2¼ inches from the bottom. At the upper end is a space for distributing the water, separated from the rest of the trough by a board sliding in grooves (so as to be removable for cleaning); the lower edge of the board is cut back at 1 inch from each side so that, when the sides rest on the bottom of the trough, in the centre there is a gap 13 inches by ¾ inch, through which the water enters the body of the trough.

The trough holds three trays, one of which is shown in isometric projection. Their capacity is about 5,500 eggs each. The sides of the tray are of wood and the bottom and ends are formed of a single sheet of perforated zinc. Should it be desired to get rid of the raw edges of the zinc at the ends a light half-round fillet of wood may be nailed across outside and the zinc bent down over it. This does not exist in Herr Jaffé's pattern, and is not shown in the drawing.

The transverse 1-inch by ½-inch strips serve both to strengthen the tray and as handles for lifting it.

The perforated zinc for incubating is of the special pattern illustrated, the holes being ¼ inch by $\frac{3}{32}$ inch. In fastening on the zinc, care should be taken not to let its raw edges project beyond the sides of the tray, as they would destroy the inner surface of the trough.

The trays are supported on nails or pegs driven into the sides of the trough at such a height that the bottom of the tray is 1½ inches from the bottom of the trough and 1¼ inches below the level of the outlet.

At the lower end of the trough is fitted a plug sufficiently large to allow it to be flushed out conveniently.

The outlet is in the form of a rectangular lip fastened to the sides and lower end of the trough. In connection with the outlet is fitted a sluice as follows:—The sides of the outlet are cut fully ½ inch shorter than the bottom, and behind it two vertical strips, ½-inch by ¼-inch, are fastened to the sides of the trough. Grooves are thus formed into which a piece of ½-inch board can be slid when required (see below).

Above the outlet the sides of the trough are braced together with a piece of 1½-inch by 1¼-inch section.

The covers of the trough are fitted as closely as possible without jamming, and have strips nailed across them to serve as handles, as shown in section.

The special pattern of perforated zinc allows the eggs to be cleaned during their early stages with a minimum amount of handling. This is done as follows:—The sluice at the foot of the trough is slid into place (it is shown in place in the drawing). When the water in the trough has risen sufficiently each tray is raised, and by moving it gently up and down in the water the silt is washed off the eggs. The sluice is then withdrawn and the water allowed to resume the level of the outlet.

The cost of the "Incubating Trough" should work out at from 14*s*. to 18*s*., according to circumstances (inclusive of tar and varnish).

To render the "Incubating Trough" suitable for hatching it should be made 1½ inches deeper and 6 inches longer, and of slightly heavier stuff. The level of the outlet should be raised to 3½ inches from the bottom, and the trays to 2¼ inches. A screen should be provided if required, as at the foot of the Hatching Trough, and two loose dams 2¾ inches high should be fitted between the trays. An extra set of No. 9 perforated zinc trays would be needed to take the eggs from the eyed stage onwards.

SANDFORT HATCHING TROUGH.

N.B.—In the Section and Plan, part of the trough has been omitted (to shorten it), but the full dimensions are given.

The Hatching Trough is similar in construction to the Incubating Trough, but narrower and deeper, and braced together with two 1½-inch by 1¼-inch pieces, one near the middle and one at the lower end.

It carries two trays, 2 feet 9 inches by 8¾ inches, as illustrated, similar to the incubating trays, but made with ordinary No. 9 perforated zinc. Their capacity is about 5,000 eggs each.

In fastening on the perforated zinc care must be taken not to let the raw edges project at the sides of the trays.

The trays are supported on nails or pegs driven into the sides of the trough, with the bottom of the tray 2½ inches from the bottom of the trough.

Between the trays is fitted a dam of ½-inch board, 3 inches high, sliding in grooves so as to be removable.

Below the second tray is a screen of No. 9 perforated zinc sliding in grooves at an angle of 45 degrees, the frame of which is preferably made of oak, to avoid warping and jamming. This screen is not necessary unless the fry are turned out of the trays into the trough.

A plug is fitted as in the Incubating Trough, and the outlet is similar, but is 3½ inches above the bottom of the trough.

The cost of the Hatching Trough as described above should work out at from 12*s*. to 16*s*. (inclusive of tar and varnish).

If the Hatching Trough is to be used for incubating, it is advisable to provide a second set of trays made of the perforated zinc used for incubating, and a sluice at the outlet to raise the water when washing the eggs.

The overflow from the Incubating and Hatching Troughs may fall directly into an open drain, or may be led down in a wooden shoot or in any convenient way, provision being also made for carrying off the water from the plug-hole.

Two trestles 2 feet 6 inches high will be found a convenient support for either trough.

APPARATUS FOR USE IN STREAMS.

FLOATING REDD.

Where it is found necessary to establish a central hatchery for the purpose of stocking a large catchment area, the transport of the fry is the principal difficulty to be contended with.

Again, it is sometimes desired to stock waters where it is not convenient to erect a hatchery, in which case the possibility of using eyed eggs instead of fry would admit of considerable saving in the expense.

The Floating Redd is designed to meet both the above wants. It consists essentially of a cage of perforated zinc, with a float round its upper edge to maintain it at the surface of the water, carrying inside three trays disposed in the same way as in the Incubating and Hatching Troughs.

The body of the Redd has a solid bottom of 1-inch boards with four 2-inches by ½-inch transverse battens outside. Sides and ends have a tenoned framework of the scantlings shown on the drawings. No. 9 perforated zinc is fastened on the inside of the upper* end and six side panels, and inside the lower end is fitted a door (shown in section). The frame of the door is of 1¾-inch by 1-inch stuff, tenoned together, with two brass butt hinges above; a hook and screw eye are provided for holding it open during the enlargement of the fry, which should take place about the period of the absorption of the yolk; two buttons are attached to the frame of the Redd below for keeping the door shut; No. 9 perforated zinc is fastened on inside. The fitting of this door must be very carefully carried out, as the slightest chink may result in the escape of many fry before the proper season.

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* In the drawings, arrows show the direction of the current.

The "float" consists of a frame, tenoned together, fastened on top of the body of the Redd. At each end is a slot with rounded edges serving as a handle for lifting the Redd.

Inside this frame there are two hinged covers framed like the other parts, with two panels of ½-inch mesh wire netting in each. The covers are provided with handles, as shown in plan and section, and a transverse ledge is nailed at each end of the Redd to support them when shut. The ledge at the upper end is 1 inch by ¾ inch, and that at the lower end is reduced to ½ inch by ½ inch to facilitate the opening of the door.

The trays are of the same pattern as the incubating trays (see page 2, and drawing), but of slightly different dimensions, viz.:— 1 foot 8¼ inches long by 1 foot 3¼ inches wide, outside, by 3¼ inches deep. They are supported on nails or pegs driven into the stiles of the side panels of the Redd, at 2½ inches from the bottom (see section, Fig. 4). For salmon eggs it is advisable to have the trays at about 9 inches from the bottom.

Should it be desired to effect an economy by using the trays of the Incubating Troughs in the Floating Redds, the simplest way would be to make the incubating trays shorter and to drive the pegs for supporting them in the Redd into ½-inch battens fastened vertically inside. It is regarded as inadvisable to decrease the width of the body of the Redd.

The cost of the Floating Redd may be estimated at somewhere about £1 10*s*.

It is intended to be moored in a stream suitable for fry, and in a good current.

The simplest attachment for the mooring chains is a strap of galvanised fencing wire placed round the Redd and stapled to its sides.

If leaves and other *debris* are plentiful, a screen should be provided at a sufficient distance above the Redd or series of Redds.

If necessary, the trays may be placed two deep in the Redd, provided there is an adequate supply of good water.

FLOATING FRY NURSERY.

In the system of fish culture pursued by Herr Jaffé the alevins are never fed in the hatching troughs; but as soon as the yolk sac has hardened, *i.e.* about ten days after hatching, they are removed to Floating Nurseries, where they are fed and kept till about four months old.

The Nursery is a simple cage. The bottom is of 1¼-inch boards; the sides and ends have panels of No. 9 perforated zinc. Above these panels is a horizontal frame 4¾ inches wide at the sides and 5 inches at the ends (in the specimen from which the dimensions were taken), round the inner edge of which is a coaming 4 inches high, on which rests the hinged cover. Behind, at the corners, are blocks to keep the cover from falling back when opened.

The cover has three panels, of which the centre one is boarded over, and the others covered with ½-inch mesh wire netting; it has strong iron hinges, and hasps which serve as handles for raising it and enable it to be padlocked if necessary.

Four handles of ½-inch diameter round iron (or 7/0 gauge wire) firmly fastened with screws in the positions shown, serve for the attachment of the chains by which the Nursery is moored, and for carrying it when necessary.

It should float with about three-quarters of its depth immersed. Its capacity will be anything from 10,000 to 30,000 fry, according to the quantity and quality of the water passing through it. In streams where the flow of water is poor, an improvement may be effected by concentrating the force of the water against the end of the Nursery. The same may be done in the case of the Floating Redd.

The cost of the Floating Fry Nursery may be taken to be somewhere about £1 5*s*.

FITTINGS FOR PONDS.

POND INLET.

This piece of apparatus consists of a horizontal shoot, in the centre of which is placed a screen to intercept the grosser constituents of water-borne *dèbris,* while at the lower end is a dam for regulating the supply of water to the pond. The direction of the stream is shown by arrows on the plan. At the upper end of the screen a solid piece of wood 4 inches high runs across the shoot, and is firmly fixed to the bottom and sides. To this the screen is hinged with strong brass hinges.

It is advantageous in some cases to make the screen instantaneously removable. This may be accomplished by utilising brass bolts for hinges.

The screen is composed of the following parts:—

(1.) A frame 3 feet 4 inches by 1 foot 7 inches outside, tenoned together.

(2.) A sheet of No. 9 perforated zinc, fixed on top of the frame by 1½-inch by ¼-inch battens nailed over it.

(3.) At the lower end of the screen a vertical piece of 1½-inch stuff is firmly fastened to the frame, running right across, and having its upper edge level with the edge of the shoot. To the down-stream side of the upper edge is nailed a strip 1 inch by 1 inch, which serves as a handle for raising the screen.

The screen must be made to fit the shoot as neatly as possible, so long as it is free to be raised and lowered (as indicated by dotted lines in the section A.-B.). It rests on two strips 3 inches high nailed to the sides of the shoot underneath.

The screen needs to be raised in order to be thoroughly cleaned on both sides from time to time. This is best done with the aid of a stiff brush.

The horizontal screen, as compared with a vertical one, offers a much larger space for the passage of the water. Its liability to clog is thereby decreased and a more regular supply of water ensured.

One of these inlets should be fitted where the water supply enters each pond, whether from a conduit or another pond. The inlet should be sunk in the ground to such a depth that its bottom is slightly below the surface level of the lower pond.

A certain amount of adjustment is possible by varying the height of the dam at the lower end of the inlet.

Its cost may be taken to be somewhere about £1.

POND OUTLET.

Each pond should, if possible, be fitted with an outlet to enable it to be emptied independently of any other with which it may be connected.

The outlet, sometimes called a "pepper-box sluice," consists of a vertical box divided into two compartments by a dam. The water passes through the front of the box into the front compartment, over the dam into the back compartment, and out through an aperture at the back.

The front of the box is composed of the following parts, all of which slide in vertical grooves (see drawings):—

(1.) At the bottom, two 1-inch boards, each 9 inches high.

(2.) Above these a screen 1 foot 11 inches high, the frame of 1¾-inch by 1-inch stuff, tenoned together; perforated zinc tacked on in front.

(3.) Next above, a similar screen 1 foot 7 inches high, the frame 1 inch by 1 inch, tenoned together; perforated zinc in front.

(4.) At the top a 1-inch board 5 inches high, level with the top of the box.

Close behind these, the sides of the box are held together by two transverse 1½-inch by 2-inch bars of oak, one at the top the other about half-way down.

The dam consists of a series of 1-inch boards sliding in vertical grooves. Each board is 9 inches high, except the top one, by which the height of the water is regulated.

A notch should be cut half-way through the lower edge of each board to provide a grip for hauling it up when the pond is to be emptied.

The opening through which the water escapes is in the back of the box, and should be cut so as to facilitate making a perfectly tight joint with the drain. The dimensions in the drawing are taken from Herr Jaffé's model.

The parts sliding in grooves should be fitted as neatly as possible to the grooves and to one another, in order to avoid waste of water, due allowance being made to prevent them from jamming when wet. Strips of tarred felt fastened to the edges of the vertical boards will assist in making the dam water-tight.

The perforated zinc to be used in the screens will be No. 9 in Fry Ponds; larger sizes may be used in ponds for large fish.

By the use of this form of outlet the fish are effectually prevented from escaping into the drains, and the pond may be gradually lowered to any desired level for the purpose of inspecting or capturing the fish. To make all safe, the top of the outlet should be provided with a cover, which may be fitted with hinges and a padlock.

The outlet should be let into the side or end of the pond in such a way as to be easily accessible, and should be sunk to such a depth that the drain is level with the bottom of the pond.

It is of the highest importance to make a tight joint with the drain, as the slightest leak may quickly destroy the embankment.

The Pond outlet should cost somewhere about 15*s*.

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